

LOG 2582



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: December 29, 1995

In reply refer to: A-95-149 and -150

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On June 20, 1995, the private pilot-owner of an American Champion 8KCAB aerobatic airplane was giving aerobatic instruction when the airplane broke apart in flight and crashed near Frankfort, Illinois. The student (also a private pilot) was fatally injured and the airplane was destroyed. Both pilots were wearing parachutes. However, the pilot-owner was ejected from the structure as it broke up, and he survived with serious injuries. The accident airplane was manufactured in 1991 and had accumulated about 890 hours total time when the accident occurred.

Separated pieces of wing and fuselage structure, including the wing fittings for the left wing primary strut, were examined in the Safety Board's materials laboratory. Fatigue cracking was found in one of the wing fittings; all other examined components contained overstress separations as a result of the fracture of the wing fittings.

The outboard ends of the wing fittings for each primary strut are bolted to the web of the wing's front spar, with one fitting on the forward side of the web and one on the aft side of the web. The fittings then make a transition to a wider spacing at their inboard end where the strut is attached with a bolt. A representative of American Champion indicated that the fittings are made from an extruded aluminum alloy tube with a rectangular cross section. Portions of the tube not used in the fitting are machined away. The sketches in figure 1 show the location of the fittings on the airplane and the approximate location of the fatigue cracking on the fittings.

The aft wing fitting for the left wing primary strut separated in overstress. The forward fitting fractured through the transition area, approximately in the center of the length of the fitting. In the area of the separation, the fitting consists of an aft leg (assembled against the forward face of the wing spar web) and a forward leg.

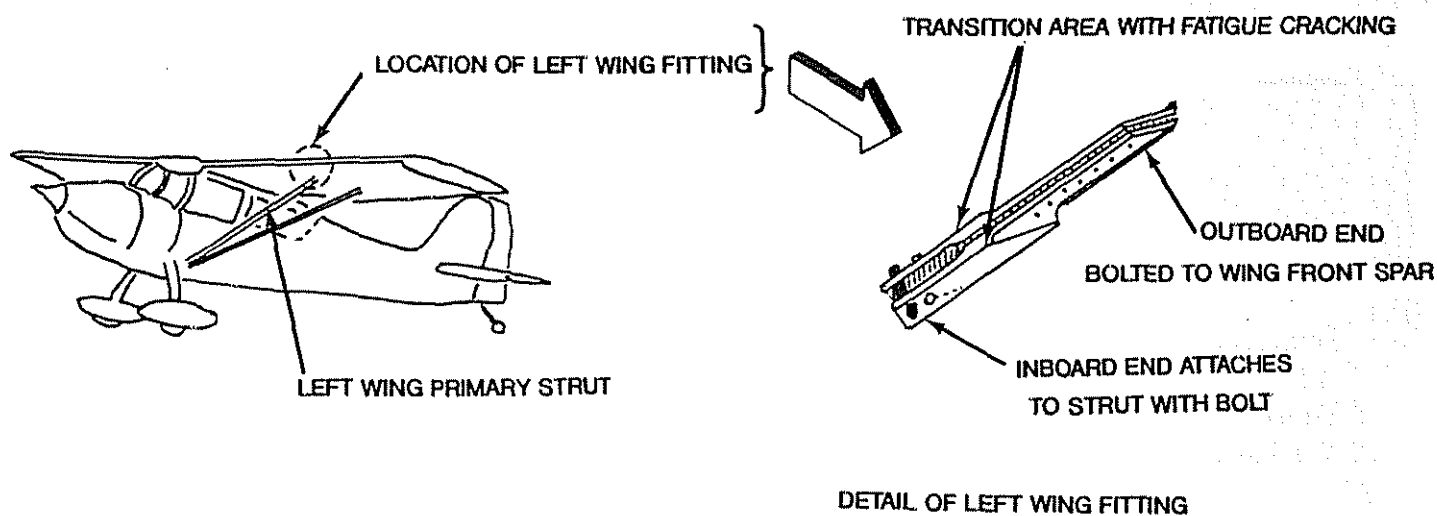


Figure 1. Location of fatigue cracking on the wing fitting for the left wing primary strut.

Examination of the fractures through the two legs of the forward fitting showed that fatigue cracking progressed almost all of the way through the aft leg and about 25 percent of the way through the forward leg. The Safety Board's investigation revealed two factors that contributed to the initiation of the fatigue cracking: scratches in the forward fitting and operation of the airplane in an abusive manner.

Initiation of the fatigue cracking in the wing fitting was from multiple locations in one of a series of small, sharp scratches in the forward edge of the shorter portion of the aft leg, in the area where the leg begins the transition to the inboard configuration. The scratches were about 0.010 inch deep and were oriented vertically across the thickness of the shorter portion of the leg. Independent secondary cracks were found in three of these scratches. The Safety Board has not determined the source of the scratches, but they may have been created during the manufacturing process. The area that contained the scratches was in the transition area of the fitting, an area that is blended after removal of excessive material. It is possible that the scratches were not entirely removed during final sanding and polishing of the surface at this time. Other manufacturers have previously made the same models now made by American Champion. However, the previous manufacturers only made these airplanes with wooden spars and different (steel) wing fittings for the lift strut. For this reason, wing fittings on airplanes made by previous manufacturers are not of concern.

A representative of American Champion indicated that their company had performed relevant repair on the accident airplane before the accident. One of the wing fittings for the right wing primary lift strut contained elongation of the strut attachment bolt holes and was therefore removed and replaced. The representative examined the fitting after the accident and found scratches similar to those on the separated fitting.

Because scratches in the wing fittings could facilitate initiation of fatigue cracking and precipitate another serious accident, the Safety Board is concerned that American Champion 8KCAB airplanes that have accumulated sufficient hours of operation may have fatigue cracks in the wing fittings for the primary struts. The Safety Board therefore believes that the wing fittings of these higher-time 8KCAB model airplanes should be subjected to an immediate, one-time inspection for scratches, using magnified visual examination, and for cracking, using an appropriate nondestructive inspection method such as dye penetrant inspection.

American Champion produces other models (8GCBC, 7GCBC, and 7ECA) with wing fittings that are very similar to the fitting that contained fatigue cracking on the accident airplane. Because of the similarity in the manufacturing process, there is a possibility that the fittings on these models could also have scratches. However, the wing fittings on these other models would be expected to have lower stresses compared to the fittings on the 8KCAB models. The 8GCBC model is not an aerobatic airplane and is certificated to a much lower maximum positive G load than the 8KCAB model (+3.8 G's compared to +6 G's); the 7GCBC model is certificated to a lower maximum positive G load (+5 G's) and has limited aerobatic capability; and the 7ECA model has a lower gross weight, is certificated to a lower maximum G load (+5G's), and has limited aerobatic capability. For these reasons, the Safety Board does not believe that the fittings on these other models need to be immediately inspected. However, the presence of scratches on the fittings of these other models and on the lower-time 8KCAB models could eventually lead to initiation of cracking, and the Safety Board believes that the fittings on these airplanes should be inspected within a reasonable time period.

Information gathered in interviews with the pilot-owner and persons familiar with his piloting technique indicates that the accident airplane was previously flown in an abusive manner, at speeds above V_{nc} and with extremely rapid control inputs to the fullest extent of their travel at speeds above V_a (aerobatic maneuvering speed, above which no full or abrupt control movements are allowed). Operation of the airplane in such a manner has the potential for exceeding the maximum normal acceleration limits of the airplane and creating high stresses in the lift struts and associated components. The previous discovery of a wing fitting with elongated strut attachment bolt holes is a further indication that the accident airplane experienced excessive stresses in the lift struts. Such stresses could greatly reduce the time needed for initiation and growth of fatigue cracking in critical components, especially in areas that have defects such as scratches.

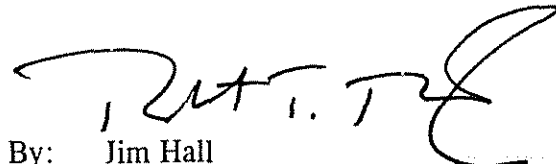
The Safety Board is concerned that other American Champion 8KCAB airplanes could have been flown in a manner not approved under the original certification. Subsequently, the Board has issued a letter to American Champion Airplane Company recommending that the company notify operators of the circumstances of this accident and warn the operators of the possible adverse consequences of flying the airplane in a manner for which it was not certificated.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Require that the wing fittings for the primary struts on all American Champion 8KCAB model airplanes with more than a specified minimum number of operating hours receive an immediate one-time inspection for scratches, using magnified visual inspection, and for cracks, using an appropriate nondestructive inspection method such as dye penetrant inspection. Fittings with scratches or cracks should be removed from service before further flight. (Class I, Urgent Action) (A-95-149)

Require that the wing fittings for the primary struts on American Champion 8KCAB model airplanes not previously inspected and on all American Champion 8GCBC, 7GCBC, and 7ECA model airplanes be inspected for scratches, using magnified visual inspection, and for cracks, using an appropriate nondestructive inspection method such as dye penetrant inspection, within a reasonable time period. Fittings with scratches or cracks should be removed from service before further flight. (Class II, Priority Action) (A-95-150)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT and GOGLIA concurred in these recommendations.


By: Jim Hall
Chairman